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Agency Problems in Target-Date Funds

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AGENCY PROBLEMS IN TARGET-DATE FUNDS

BY

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ACCEPTANCE

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ABSTRACT

Agency Problems in Target-Date Funds

BY

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Target-Date Funds (TDFs) facilitate retirement planning by varying asset allocation over time with the goal of reducing portfolio risk. We explore potential agency problems in TDFs by examining their return performance and flow-performance relation. We find that TDFs under-perform balanced funds (BFs) which are also approved as a default option along with TDFs in 401(k) plans with automatic enrollment. We show that the under-performance is driven by TDFs that have a fund-of-fund structure and constituent funds with high expense ratios or poor performance within the fund family. Additionally, we discover an absence of flow-performance relation in TDFs while BFs exhibit the convex flow-performance relation shown for mutual funds. Our evidence suggests the presence of agency problems in TDFs arising from investor inertia, weak incentives for fund managers to outperform peers, and opportunities for fund families to gain private benefits.

Agency Problems in Target-Date Funds

"Of all the issues that the SEC is examining at the moment, our review of target date funds is one that may most directly affect everyday Americans . . . "

- Mary Schapiro,

Chair, Securities and Exchange Commission, at the public hearing on Target-Date Funds and other similar investment options, held on June 18, 2009.

1. Introduction

Target-Date Funds (TDFs) are popular retirement investment vehicles that follow a predetermined schedule for rebalancing their mix of equity and fixed-income securities over time. Pension Protection Act (PPA) of 2006 resulted in widespread adoption of TDFs as the default option in 401(k) plans with automatic enrollment.[1] This paper provides evidence of agency problems in TDFs that arise when economic agents are not properly incentivized or when agents face conflicts of interest while executing their duties to principals. Provision of incentives in the case of mutual funds can be in the form of greater (lower) flows following good (poor) performance while conflicts of interest manifests through self-dealing. Our findings raise questions regarding the suitability of TDFs as a default option in 401(k) plans.

In the first part of the paper focusing on incentives facing the TDFs, we study the flow-performance relation and find that flows do not respond to past performance suggesting

[1]Among plans with automatic enrollment, 87% administered by Vanguard and 96% by Fidelity used TDFs as the default instrument in 2008. See GAO report to Chairman, Special Committee on Aging, U.S. Senate, at http://www.gao.gov/new.items/d1031.pdf

that retirement plan participants neither reward nor punish TDFs.[2] This, in turn, seems to indicate lack of incentives for TDFs to provide superior performance for their investors. In contrast to TDFs, balanced funds (BFs), which are also approved but are not as widely used as default option in 401(k) plans, exhibit convex flow-performance relation indicating that its investors chase performance. The test of relative performance shows that TDFs trail BFs by 48 (86) basis points annually based on risk-adjusted net-of-fee (gross-of-fee) performance.

In the second part of the paper, we examine different subgroups within TDFs to show that the subgroup with the greatest scope for conflicts of interest under-performs the rest. TDFs structured as Single Funds (SF) invest directly in stocks and bonds while those with the fund-of-fund (FOF) structure either invest in other mutual funds within the same fund family (*Internal* FOF) or in funds outside the family (*External* FOF). Of the three structures, *Internal* FOFs are likely to have the greatest potential for conflicts of interest. In particular, they may choose to include funds with high expense ratios to increase revenues to the family. Alternately, they may include funds with poor performance and/or low flows to sustain funds that may be less marketable. Why would plan sponsors who have the fiduciary responsibility allow this? A possible explanation stems from their own conflicts of interest due to a desire to secure votes in favor of management on shareholder proposals and the prospect to overweight securities of the firm in institutional portfolios (e.g., Davis and Kim, 2007; Cohen and Schmidt, 2009). In this study, we do not attempt to distinguish between the roles played by the plan sponsor and the fund family. Thus, TDFs with the *Internal* FOF

[2]Plan participants' failure to punish poor performance is consistent with the evidence shown in prior studies that suggest inertia among retirement investors in changing the asset allocation of their 401(k) plans (e.g., Madrian and Shea, 2001; Agnew, Balduzzi, and Sunden, 2003; Mitchell, Mottola, Utkus, and Yamaguchi, 2006; Choi, Laibson, Madrian, and Metrick, 2006; Benartzi and Thaler, 2007). In addition, Gruber (1996) suggests that pension plan participants that are restricted by their plans may not move money out of funds that perform poorly.

structure appear to face the greatest potential for agency problems in the principal-agent relation. We investigate the relative performance of the three sub-categories of TDFs and find that the *Internal* FOFs under-perform SFs by 58 (132) basis points and *External* FOFs by 55 (63) basis points based on risk-adjusted net-of-fee (gross-of-fee) performance. In contrast, *External* FOFs perform at par with the SFs.

In the third part, we provide further evidence suggestive of the channels for the manifestation of agency problems using the holdings of TDFs with the FOF structure obtained from the N-Q, N-CSR, and N-CSRS filings mandated by the Securities and Exchange Commission (SEC). We find that among funds that are constituents of TDFs, those with higher expense ratios or lower performance have a greater probability of inclusion in an *Internal* FOF than in an *External* FOF. Similarly, among funds that belong to a family that offers TDFs with the *Internal* FOF structure, once again funds with higher expense ratios or lower performance have a greater probability of inclusion in their TDFs. Our results are robust after controlling for family and fund characteristics and to other specifications including estimation of alphas over different horizons, alternate definition of expense ratios, trends over time, and variations in asset allocation. Furthermore, we perform bootstrap simulations using residual and factor resampling approach of Kosowski, Timmermann, Wermers, and White (2006) to show that the documented under-performance is not attributable to sampling variability.

Overall, the findings in this paper have important policy implications as retirement monies are defaulted into TDFs following their approval as Qualified Default Investment Alternative (QDIA) in 401(k) plans. During the financial crisis in 2008, investors close to retirement lost anywhere between 3.6% and 41% among the 31 TDFs with 2010 Target Date.[3] The loss prompted a joint public hearing by the SEC and the Department of Labor (DOL)

[3]Speech by Mary Schapiro, Chair of SEC, at the hearing on TDFs held on June 18, 2009. A transcript of the hearing is found at http://www.dol.gov/ebsa/pdf/TDFhearingtranscript.pdf

leading to a regulation that requires prominent display of asset allocation in the marketing material for TDFs. While the regulation helps in alleviating the ignorance of investors, it falls short of addressing the potential agency problems highlighted in this paper. The findings in our paper point to a conceivable solution that comes from understanding the difference in the flow-performance sensitivity of BFs and TDFs resulting from their investor bases. While TDFs are almost exclusively used by retirement investors, a major portion of BFs' assets are held outside retirement plans.[4] Our results indicate that opening TDFs to non-retirement accounts whose investors are performance sensitive, as is the case with BFs, may help bridge the gap in performance of TDFs relative to BFs. In addition, closer attention could be paid to the holdings of TDFs with the *Internal* FOF structure where the mutual fund families might face conflicts of interest and therefore, may not always make investment decisions in the best interest of their shareholders.

The remainder of the paper is organized as follows. Section 2 presents the related literature and hypotheses. Section 3 describes the data and variables. Section 4 provides evidence on lack of flow-performance sensitivity in TDFs followed by a discussion of the tests of under-performance. Section 5 performs a battery of robustness checks and Section 6 concludes.

2. Related literature and Hypotheses Development

This paper contributes to several strands of the finance literature. First, theoretical studies analyze the life-cycle model of consumption and portfolio choice by introducing con-

[4]According to a report by the Investment Company Institute, 88% of TDF assets were held in retirement accounts in the year 2007 compared to 46% of balanced fund assets. See The US retirement market, 2007 http://www.ici.org/pdf/fm-v17n3.pdf - Research Fundamentals, July 2008, Vol 17, No.3.

straints faced by an aging investor and deviations from the mean-variance framework (e.g., Bodie, Merton, and Samuelson, 1992; Viceira, 2001; Cocco, Gomes, and Maenhout, 2005; Gomes and Michaelides, 2005; Benzoni, Collin-Dufresne, and Goldstein, 2007; Polkovnichenko, 2007; Gomes, Kotlikoff, and Viceira, 2008; Viceira, 2009; Chai, Horneff, Maurer, and Mitchell, 2009; Poterba, Rauh, Venti, and Wise, 2009; Koijen, Nijman, and Werker, 2010). In particular, Bodie and Treussard (2007) evaluate the choice of TDFs in retirement plans and conclude that they are not appropriate for risk averse investors or for those who have a high exposure to market risk through their human capital. Although TDFs are gaining popularity among investors, empirical research on these funds is still in its infancy. In their pioneering work, Mitchell, Mottola, Utkus, and Yamaguchi (2007) study the impact of inclusion of TDFs in 401(k) plans of a single provider and find that TDFs reduce the problem of extreme asset allocation and idiosyncratic portfolio risk. Ours is the first empirical study examining the cross-sectional variations in the return performance as well as the flow-performance relation of TDFs.

Second, we contribute to the strand of literature that pertains to investor behavior in retirement plans which provides evidence that plan participants are passive (e.g., Madrian and Shea, 2001; Agnew, Balduzzi, and Sunden, 2003; Choi, Laibson, Madrian, and Metrick, 2006; Mitchell, Mottola, Utkus, and Yamaguchi, 2006; Benartzi and Thaler, 2007) and lack financial literacy (e.g., Hilgert, Hogarth, and Beverly, 2003; Lusardi and Mitchell, 2006, 2007a,b,c). Inertia among retirement plan participants provides captive investors leading to potential agency problems in TDFs.

Third, we contribute to the flow-performance literature on mutual funds that documents a convex relation between flows and past performance resulting in competition amongst managers to outperform their peers (e.g., Chevalier and Ellison, 1997; Sirri and Tufano, 1998; Karceski, 2002; Berk and Green, 2004; Ivković and Weisbenner, 2009). Additionally,

it has been shown that fund flows are affected by factors like advertising (e.g., Jain and Wu, 2000; Gallaher, Kaniel, and Starks, 2005; Barber, Odean, and Zheng, 2005), spill over effects from star funds (e.g., Nanda, Wang, and Zheng, 2004), name changes (e.g., Cooper, Gulen, and Rau, 2005), and investors' participation costs (e.g., Huang, Wei, and Yan, 2007) to name a few. Flow-performance relation among pension funds is analyzed by Guercio and Tkac (2002) who find that the relation is approximately linear as pension funds punish poorly performing managers and do not disproportionately flock to winners. Given the inertia among retirement plan participants, they are unlikely to punish poor performance by withdrawing capital or reward good performance with more capital infusion. Hence, we hypothesize that flows to TDFs should be unrelated to their past performance.

Finally, we contribute to the literature dealing with the agency issues in delegated portfolio management. Some of the problems analyzed in extant literature are risk-shifting (e.g., Brown, Harlow, and Starks, 1996; Chevalier and Ellison, 1997; Blake, Elton, and Gruber, 2003; Hu, Kale, Pagani, and Subramanian, 2011), window dressing (e.g., Lakonishok, Shleifer, Thaler, and Vishny, 1991; Carhart, Kaniel, Musto, and Reed, 2002; He, Ng, and Wang, 2004; Ng and Wang, 2004; Meier and Schaumburg, 2004; Agarwal, Gay, and Ling, 2011), career concerns (e.g., Chevalier and Ellison, 1999; Brown, Goetzmann, and Park, 2001), and churning of assets (e.g., Allen and Gorton, 1993; Dow and Gorton, 1997). While the above studies focus on issues at the fund level, Khorana and Servaes (1999), Massa (2003), Gaspar, Massa, and Matos (2006), Guedj and Papastaikoudi (2008), and Cici, Gibson, and Moussawi (2010) study the "strategic" decisions made in the interests of the fund family.

Given that mutual funds manage 52% of defined contribution (DC) plan assets, it is important for fund families to attract retirement plan sponsors.[5] In this context, Davis

[5]The US retirement market, 2007 http://www.ici.org/pdf/fm-v17n3.pdf - A report by Investment Company Institute, July 2008, Vol 17, No.3.

and Kim (2007) argue that fund families may not demand good corporate governance from firms whose 401(k) plans they manage while Cohen and Schmidt (2009) find that mutual fund families that act as trustees systematically overweight the sponsor firms' stock in the families' funds. Hence, it is conceivable that plan sponsors might benefit from favorable voting as well as overweighting of the firm's stock in return for letting plan trustees include under-performing or high-fee funds in TDFs offered in the 401(k) plan. Passive principals coupled with conflicted agents suggest that TDFs may be prone to agency problems. A natural baseline to measure the performance of TDFs is provided by BFs.[6] On one hand, BFs are an alternate choice available to plan sponsors as QDIA and have a similar investment universe but are less susceptible to agency problems mentioned above as they are widely used outside retirement plans. If agency problems affect the performance adversely, we expect TDFs to under-perform BFs. On the other hand, BFs differ from TDFs in that their asset allocation is fixed during inception while managers of TDFs need to rebalance the allocation from time to time based on the glide path (predetermined asset allocation schedule). If investors are willing to pay a price for this additional service, it may be reflected as lower expected returns. Hence, we hypothesize that TDFs should under-perform BFs on the basis of risk-adjusted performance.

To disentangle the two explanations for the underperformance of TDFs, we first divide TDFs into two groups, funds that invest in other mutual funds (FOFs) and those that invest in stocks, bonds, and other asset classes (SFs).[7] Next, we compare the performance of each group with that of BFs. If the under-performance is due to time-varying reallocation of assets, we expect both sub-categories of TDFs to under-perform BFs. Thus, we can rule out

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[6]Similar comparison is made by Gomes, Kotlikoff, and Viceira (2008).

[7]Funds with SF structure might invest a small portion (less than 20%) of their assets in money market funds or index funds.

time-varying reallocation of assets as the cause of under-performance if any one of the subcategories of TDFs under-performs BFs. If the under-performance is due to the potential for conflicts of interest, we expect TDFs with the FOF structure to under-perform as this structure is likely to provide discretion to include funds that increase revenues to the family or redirect flows as desired. However, there are two other factors that may cause the under-performance. Firstly, diversification across managers, a feature offered by TDFs with the FOF structure may lower expected returns. Secondly, FOFs charge dual layer of fees which may also reduce the net-of-fee returns. Hence, we hypothesize that TDFs with the FOF structure should under-perform BFs while TDFs with the SF structure should perform at par with BFs.

To disentangle the cause of under-performance of TDFs with the FOF structure, we further analyze their subcategories. While some FOFs invest in funds offered by their own family (*Internal FOFs*), others invest in funds from other families (*External FOFs*).[8] Few studies have examined the FOFs in the hedge fund industry (e.g., Brown, Goetzmann, and Liang, 2002; Agarwal and Kale, 2007; Ang, Rhodes-Kropf, and Zhao, 2008) while the FOF structure in mutual funds is largely unexplored with the exception of Bhattacharya, Lee, and Pool (2010). If diversification across managers causes the under-performance, TDFs with *Internal* as well as *External* FOF structure should under-perform those with the SF structure. However, if dual layer of fees causes the under-performance, TDFs with *Internal* as well as *External* FOF structure should under-perform those with the SF structure in the net-of-fee but not in the gross-of-fee specification. However, if one of them under-performs SFs while the other does not, then the under-performance is not attributable to diversification across

[8]Apart from *External* and *Internal* FOFs, there are a few funds that invest in funds within the family as well as funds outside the family (*Mixed FOFs*) and we combine them with *External* FOFs as dicussed later in Section 4.2.

funds or dual layer of fees.[9]

A TDF with the FOF structure may choose to invest internally due to informational advantages or due to the flexibility to move assets across funds with minimal transaction costs. Elton, Gruber, and Green (2007) find that investors who confine their investments to a single fund family tend to have more risky portfolios than if they select similar funds across different families. Another explanation for internal investing could be that it provides greater scope for "strategic" decision making. For instance, fund families may choose constituent funds with high expense ratio or redirect flows to funds within their stable that are experiencing poor performance or low flows. If the costs associated with "strategic" selection in the case of *Internal* FOFs exceed the benefits in the form of lower transaction costs, *Internal* FOFs should under-perform *External* FOFs which forms our next hypothesis.

To find direct evidence of agency problems, we examine the constituent funds of *Internal* FOFs and compare them with other funds within the family as well as the constituents of *External* FOFs.[10] If agency problems distort the selection process of constituent funds of *Internal* FOFs, we hypothesize that constituent funds of *Internal* FOFs would have higher expense ratios or lower performance or lower flows compared to other funds in the family or those selected for *External* FOFs.

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[9]Systematic differences in asset allocation cannot explain the under-performance as we compare risk-adjusted performance after explicitly controlling for differences in asset allocation.

[10]Gaspar, Massa, and Matos (2006) argue that from a family's perspective, expected assets are higher with a mix of funds delivering good and bad performance as opposed to funds reporting uniformly mediocre performance. To this end, fund families may favor funds that are adding most value to the family at the cost of other funds within the family.

3. Data and variable construction

We describe the data sources for our analyses and explain the main variables in this section.

3.1. Data Description

The main source of data for our paper is the survivor-bias-free mutual fund database from the Center for Research in Security Prices (CRSP). While we identify BFs using the Lipper objective code provided by CRSP, we use the target year in the fund's name to identify TDFs and ensure that they vary the equity/bond allocation along the glide path. To analyze the constituent funds of TDFs with the FOF structure, we collect data from Securities and Exchange Commission's (SEC) quarterly filings (N-Q, N-CSR, N-CSRS) in which the funds are required to provide a complete list of their holdings. We merge our dataset with CRSP mutual fund database using fund names to obtain fund characteristics. Consistent with Wermers (2000), we combine the characteristics of the share classes to obtain the corresponding characteristic of the fund using the weighted averages in which the weights are based on the assets in each share class. For this study, we consider the entire universe of TDFs over the period January 2001 to December 2008 when the number of funds grew from 16 to 280 resulting in over 3,100 fund-quarter observations.

From the top panel of Table 1, we can see that the assets under management (AUM) of TDFs experienced a 11-fold increase from $11.29 billion to $126.79 billion while BFs experienced a modest increase. At year-end 2007, more than two-thirds of 401(k) plans in the EBRI/ICI database included TDFs in their investment menu.[11] From the middle panel,

[11]See Investment Company Institute web page http://ici.org/faqs/faqs_target_date

we can see that TDFs with the FOF structure grew phenomenally from $9.70 billion to $121.08 billion while TDFs with the SF structure grew marginally during the same period. The bottom panel shows the growth of *Internal* FOFs from $9.70 billion in 2001 to $114.45 billion in 2008 and *External* FOFs from $9.00 million in 2005 to $1.58 billion in 2008. Thus, it is clear that the growth of TDFs is largely attributable to TDFs with the *Internal* FOF structure.

3.2. Key Variables

To analyze the flow-performance relation, we follow Sirri and Tufano (1998) and define $NetFlows$ for fund i in quarter t as

$$NetFlows_{it} = \frac{AUM_{it} - AUM_{it-1} * (1 + R_{it})}{AUM_{it-1}}, \tag{1}$$

where AUM_{it} is the assets under management of fund i in quarter t and R_{it} is the return of fund i in quarter t. Another important variable in our study is *fund performance*. While it is the dependent variable for a majority of tests, we use it as an explanatory variable in the flow-performance analysis. To measure performance, we use the risk-adjusted net-of-fee return (alpha) obtained using an extension of Carhart (1997) four-factor model. While the Carhart (1997) model has been used to measure the performance of domestic equity funds, it may not be appropriate for TDFs as they also invest in bonds and international equity (e.g., Comer, 2006; Blake, Elton, and Gruber, 2006). Failure to control for this additional exposure attributes the excess return earned by these asset classes to alpha.

We use excess returns on *Barclay's Capital U.S. Aggregate index* and *MSCI EAFE* index as our bond and international equity factors as almost all TDFs use them as the

benchmarks for bond and international equity components of their portfolios.[12] Thus, our first performance measure for a fund in a given sub-period is the alpha estimated using the following model:

$$r_{i,t} = \alpha_i + \beta_{1,i} MKTRF_t + \beta_{2,i} SMB_t + \beta_{3,i} HML_t + \beta_{4,i} UMD_t + \beta_{5,i} BOND_t + \beta_{6,i} INTEQ_t + \epsilon_{i,t} \quad (2)$$

where $r_{i,t}$ is the excess return earned by fund i in month t and $MKTRF_t$ is the value-weighted return on all NYSE, AMEX, and NASDAQ stocks minus the one-month Treasury bill rate for month t. Additionally, SMB_t, HML_t, and UMD_t refer to the returns on value-weighted, zero-investment, factor-mimicking portfolios for size, book-to-market equity, and one-year momentum in stock returns respectively. $BOND_t$ is the return on the Barclay's Capital U.S. Aggregate index minus the one-month Treasury bill rate for month t, and $INTEQ_t$ is the return on the MSCI EAFE index minus the one-month Treasury bill rate for month t. Since our study spans a period of eight years, computing a single alpha for the whole period might be too restrictive as it forces the funds to have constant betas over a long period. Hence, we split the data into four time periods of two years each, estimate alphas using 24 month intervals, and run a panel regression by pooling observations in the four periods.[13]

A frequently cited critique of alphas is the questionable accuracy of the underlying asset pricing model. An alternate measure of performance used in literature is the Sharpe ratio. For each fund, we calculate the monthly Sharpe ratio for a given year by dividing the average monthly excess returns by their standard deviation and subsequently annualize it. While

[12]Blake, Elton, and Gruber (2007) use a similar multifactor model except for the momentum factor to measure the performance of stock mutual funds that have exposure to bonds and international equity.

[13]In specifications involving *External* and *Mixed* FOFs, we are restricted to using only the last four years as these funds came into existence only in 2005.

the six-factor alpha measures the risk-adjusted returns based on our asset pricing model, Sharpe ratio measures the same by defining risk as the volatility of fund returns. Although, this measure is useful to an investor that is not fully diversified, one must keep in mind that Sharpe ratio can be inflated by reducing the volatility of returns. For robustness, we repeat our analysis using risk-adjusted gross-of-fee performance measures. As CRSP mutual fund database reports the net-of-fee returns, we add the expense ratios to estimate the gross-of-fee returns. Additionally, in untabulated tests, we repeat our analysis using alphas estimated over 18 and 36 month intervals and obtain qualitatively similar results.

3.3. Control Variables

Our control variables based on extant literature are expense ratio (percentage of fund assets paid for operating expenses, management fees, and 12B-1 fees excluding sales charges), age (number of years since inception), turnover ratio (ratio of minimum of purchases and sales made by the fund to the total assets under management), and AUM (dollar value of assets in fund's portfolio). Since age and AUM are known to have skewed distributions, we take the logarithm of these variables. In the case of TDFs with the FOF structure, the expense ratio as reported in CRSP does not include the fees paid to constituent funds. Similarly, the turnover ratio as reported in CRSP understates the actual turnover as it does not include the turnover of the underlying funds. Hence, we augment the values of expense ratio and turnover ratio with the corresponding average values of the constituent funds. To control for family effects, we include the total AUM of the family as an independent variable. We also include the proportion of assets invested in bonds as an additional variable to control for differences due to the asset allocation that may not be captured by our bond factor. Finally, as our data have panel structure, we allow for clustering of standard errors by fund families and quarters for all our tests unless specified otherwise.

4. Empirical Results

In this section, we examine the potential for agency problems in TDFs by analyzing the flow-performance relation of TDFs and BFs. Since TDFs are targeted at retirement investors who may be passive or captive, they are unlikely to reward good performance or punish poor performance. This inaction implies that in the case of TDFs, flows may be unrelated to performance. BFs on the other hand are not primarily targeted at retirement plan participants. Moreover, despite being approved as QDIA, they are not prevalently used as the default instrument. Given that they are chosen by active investors similar to those investing in open-end mutual funds, we expect their flow-performance relation to be similar to that of equity funds.

4.1. Analysis of Flow-Performance Relation

While Sirri and Tufano (1998) focus on equity funds, we extend the analysis to TDFs and BFs. To evaluate fund performance for each quarter, we use the prior 24 monthly returns of a fund and estimate its alpha using the six-factor model as explained in Section 3.2. For our univariate analysis, we divide the funds into deciles based on their performance for that quarter and calculate the average net flows in the subsequent quarter for each performance decile using the definition provided in Section 3.2. In unreported tests, we find the flow-performance relation to be convex for BFs. However, in the case of TDFs, there is no clear pattern in the flow-performance relation suggesting that investors fail to incentivize their fund managers. We repeat our analysis using the four-factor model and find qualitatively similar results.

For the multivariate analysis, we divide our data into BFs and TDFs and repeat the

analysis for both sub-groups using a simple linear regression given by the following model:

$$\begin{aligned} NetFlows_{i,t+1} =& \beta_0 + \beta_1 Perf_{i,t} + \beta_2 LogAUM_{i,t} + \beta_3 ExpenseRatio_{i,t} \\ &+ \beta_4 ObjFlows_{i,t+1} + \beta_2 RetVolat_{i,t} + \epsilon_{i,t}, \end{aligned} \tag{3}$$

where $NetFlows_{i,t+1}$ is the net percentage growth of fund i in quarter $t+1$, $Perf_{i,t}$ is the net-of-fee six-factor alpha, $LogAUM_{i,t}$ is the log of assets under management of fund i in quarter t, $ExpenseRatio_{i,t}$ is the expense ratio of fund i in quarter t, $ObjFlow_{i,t+1}$ is the growth of funds in quarter $t+1$ with fund i's investment objective, and $RetVolat_{i,t}$ is the standard deviation of returns over the previous 24 months ending in quarter t. In the case of TDFs with the FOF structure, expense ratio is augmented by the average expense ratio of the constituent funds.

While the above model assumes a linear relation, we follow Sirri and Tufano (1998) and use the following piece-wise linear model to capture the convexity of the flow-performance relation.

$$\begin{aligned} NetFlows_{i,t+1} =& \beta_0 + \beta_1 LowPerf_{i,t} + \beta_2 MidPerf_{i,t} + \beta_3 HighPerf_{i,t} \\ &+ \beta_4 LogAUM_{i,t} + \beta_5 ExpenseRatio_{i,t} + \beta_6 ObjFlows_{i,t+1} \\ &+ \beta_7 RetVolat_{i,t} + \epsilon_{i,t}. \end{aligned} \tag{4}$$

We define $LowPerf_{i,t}$ as $Min(0.2, RANK_{i,t})$ where $RANK_{i,t}$ is defined as the percentile performance (measured as the net-of-fee six-factor alpha) of fund i in quarter t relative to other funds with the same investment objective. Similarly, we define $MidPerf_{i,t}$ as $Min(0.6, RANK_{i,t} - LowPerf_{i,t})$ and the highest quintile of performance as $HighPerf_{i,t} = RANK_{i,t} - (LowPerf_{i,t} + MidPerf_{i,t})$. Finally, all other variables are as defined in Equation 3.

Results from the linear model are reported in Table 2. We can see that the flows respond

to past performance in the case of BFs while flows are unrelated to performance for TDFs. The results from the piece-wise linear model provides evidence of a convex flow-performance relation for BFs. We find the slopes of the performance-growth relation over the three ranges to be significantly different from zero and based on the pairwise t-tests, we can reject the hypothesis that performance sensitivity of the lowest quintile is the same as that of the highest quintile as well as the middle three quintiles combined as in Sirri and Tufano (1998). However, in the case of TDFs, we fail to reject the hypothesis that performance sensitivity of the lowest quintile is the same as that of the highest quintile as well as the middle three quintiles. Thus, the flow-performance relation of BFs is convex during our sample period while there is no relation between flows and performance for TDFs. Another interesting point is that while fund flows to mutual funds are negatively related to expense ratios in the case of BFs, they are not sensitive to expense ratios in the case of TDFs. Thus, unlike BFs, flows to TDFs are not related to performance or expenses and hence fail to provide managers with incentives to outperform their peers. Instead, it incentivizes fund families to sell poorly performing or high-fee funds which establishes the potential for agency problems in TDFs. In unreported tests, we repeat the analysis with four-factor alphas as performance measures as well as family fixed effects model and find qualitatively similar results.

Next, we present evidence of agency problems in TDFs and a mechanism through which it manifests. We begin with the univariate analysis of BFs, TDFs, and their subcategories followed by our tests for under-performance and conclude with our analysis of the determinants of the constituents of FOFs that invest internally.

4.2. Univariate Analysis of BFs and TDFs

In Table 3, we present the average fund characteristics of TDFs and BFs in the first two columns and the differences in the means in the third column. From the table, we can see that TDFs under-perform BFs by 1.35% (2.52%) annually on a net-of-fee (gross-of-fee) risk-adjusted basis. Additionally, we find lower Sharpe ratios for TDFs relative to BFs both on net-of-fee and gross-of-fee basis. Based on average fund characteristics, BFs are of comparable size, older, have lower net flows, lower equity allocation, higher bond allocation, and lower volatility of monthly returns compared to TDFs. It is interesting to note that TDFs under-perform BFs despite having greater volatility of returns and lower allocation to bonds.

In Table 4, we provide the characteristics of TDFs having the FOF and SF structures in the first two columns and the differences in the means in the third column. We find that based on our risk-adjusted performance measure, FOFs under-perform SFs by 1.76% (2.96%) annually on a net-of-fee (gross-of-fee) basis. Furthermore, we find lower Sharpe ratios for FOFs relative to SFs both on net-of-fee and gross-of-fee basis. Additionally, FOFs tend to be larger, younger, and have higher net flows, higher equity component, lower bond component, and higher volatility in monthly returns compared to SFs. Once again, we find that FOFs under-perform SFs despite having higher volatility of returns and lower bond allocation.

In the first three columns of Table 5, we present the fund characteristics of the three sub-groups of FOFs namely *Internal*, *External*, and *Mixed* FOFs. In the remaining three columns, we present the differences in the means. From the fourth column, we can see that the *Internal* FOFs under-perform *External* FOFs by 29 (62) basis points annually on a net-of-fee (gross-of-fee) risk-adjusted basis. However, we find higher Sharpe ratio for *Internal* FOFs relative to *External* FOFs both on net-of-fee and gross-of-fee basis. This might mean

that *Internal* FOFs are exposed to greater systematic risk relative to *External* FOFs.

Internal FOFs are larger, older, and have higher turnover ratio, lower flows, lower expense ratio, lower equity allocation, higher bond allocation, and lower volatility in monthly returns. Additionally, we report the weighted average turnover ratio and expense ratio of the constituent funds. We can see that the *Internal* FOFs have constituents with greater expense ratios and higher turnover ratios. While the revenue generated from the fees paid to constituent funds is redirected to the fund family's coffers in the case of *Internal* FOFs, it is paid to other fund families in the case of *External* FOFs. From the fifth and sixth columns, we can see that the *Mixed* FOFs are comparable in performance to the *Internal* FOFs but under-perform *External* FOFs. For our subsequent analysis, we combine *Mixed* FOFs with the *External* FOFs as managers of both categories have the option of including funds from families outside. To the extent that managers of *Mixed* FOFs have opportunities for "strategic" selection, it will bias our tests against finding under-performance. Our results are qualitatively similar when we repeat our analysis after excluding *Mixed* FOFs from the data.

4.3. Performance of Target-Date Funds relative to Balanced Funds

We start our multivariate analysis by comparing the performance of TDFs with that of BFs. Our data for this test consists of all fund-quarter observations during the period January 2001 to December 2008. We use the following model to conduct our analysis:

$$\begin{aligned} Perf_{i,t} = \kappa_0 &+ \kappa_1 TDF_i + \kappa_2 ExpenseRatio_{i,t} + \kappa_3 LogAge_{i,t} \\ &+ \kappa_4 LogAUM_{i,t} + \kappa_5 Turnover_{i,t} + \kappa_6 NetFlow_{i,t} \\ &+ \kappa_7 FamilyAUM_{i,t} + \kappa_8 Bond_{i,t} + \epsilon_{i,t}, \end{aligned} \tag{5}$$

where the dependent variable $Perf_{i,t}$ is the performance measure of the i^{th} fund in the t^{th} quarter and TDF_i is a dummy variable that takes the value 1 if the i^{th} fund is a TDF and 0 otherwise. $LogAge_{i,t}$ is the log of age of the i^{th} fund in the t^{th} quarter while $Turnover_{i,t}$ is the turnover ratio of the i^{th} fund in the t^{th} quarter. In the case of TDFs with the FOF structure, $Turnover_{i,t}$ includes the average turnover ratio of the constituent funds. Although we use risk-adjusted performance measures, we control for any residual impact of asset allocation by including $Bond_{i,t}$, the percentage of assets invested by fund i in fixed income securities in the t^{th} quarter. To control for family effects, we include $FamilyAUM_{i,t}$, the log of assets under management of the fund family. All other variables are as defined in Equation 3.

We present the results for six-factor alpha as the performance measure in columns three and four of Table 6 while columns five and six contain corresponding results with Sharpe ratio as the performance measure. Since our baseline case is balanced funds, the negative sign on the TDF dummy indicates that TDFs under-perform BFs. This under-performance ranges from 48 basis points annually based on net-of-fee alphas to 86 basis points annually based on gross-of-fee alphas. Additionally, TDFs also have lower Sharpe ratios compared to BFs as indicated by the negative coefficient of $-0.59\,(-0.60)$ for the net-of-fee (gross-of-fee) Sharpe ratio results. The greater under-performance of the gross-of-fee specification indicates that BFs tend to have higher expense ratios. To compute the average six-factor alpha for each of the category of funds, we evaluate Equation 5 using the mean values for the control variables. Based on our calculations, the average net-of-fee (gross-of-fee) annual six-factor alpha for TDFs is $-1.27\,(-0.07)$ while that of BFs is $-0.79\,(0.78)$.

To ensure that the under-performance that we document does not occur by chance, we perform bootstrap simulation comparable to the residual and factoring procedure described in Kosowski, Timmermann, Wermers, and White (2006). To start with, we estimate the alphas, factor loadings, and residual returns using the six-factor model for all TDFs and

BFs in our data for each of the four sub-periods and store the coefficient estimates $\{\hat{\beta}_{1,i}$, $\hat{\beta}_{2,i}$, $\ldots$ $\hat{\beta}_{6,i}$, $i = 1, 2, \ldots, N\}$ and the time series of the estimated residuals $\{\hat{\epsilon}_{i,t}, i = 1, 2, \ldots N, t = 1, 2, \ldots T\}$. Subsequently, for each bootstrap iteration b, we draw samples with replacement from the funds' stored residuals $\{\hat{\epsilon}^b_{i,t_e}, t_e = s^b_1, s^b_2, \ldots s^b_T\}$, and the factor returns $\{MKTRF^b_t, SMB^b_t, HML^b_t, UMD^b_t, BOND^b_t, INTEQ^b_t, t = u^b_1, u^b_2, \ldots u^b_T\}$ where $s^b_1, s^b_2, \ldots s^b_T$ and $u^b_1, u^b_2, \ldots u^b_T$ denote the time reordering imposed by the bootstrap. This enables us to construct the time series of simulated returns for all the BFs and TDFs in each of the sub-periods subject to zero alphas as follows:

$$\begin{aligned} r^b_{i,t} =& \hat{\beta}_{1,i} MKTRF^b_t + \hat{\beta}_{2,i} SMB^b_t + \hat{\beta}_{3,i} HML^b_t \\ &+ \hat{\beta}_{4,i} UMD^b_t + \hat{\beta}_{5,i} BOND^b_t + \hat{\beta}_{6,i} INTEQ^b_t + \hat{\epsilon}^b_{i,t_e} \end{aligned} \tag{6}$$

where $r_{i,t}, MKTRF_t, SMB_t, HML_t, UMD_t, BOND_t, INTEQ_t,$ and $\hat{\epsilon}_{i,t}$ are as defined in Subsection 3.2 and b refers to the bootstrap number. The resulting simulated returns thus generated have the same number of funds in the cross-section as well as the same number of return observations per fund as in the data. We then reestimate the net-of-fee alphas for the TDFs and BFs for each of the four sub-periods and repeat the analysis in Equation 5 using the bootstrapped alphas to test whether the coefficient of the TDF dummy is negative. We run a total of 1,000 bootstrap iterations and find the mean value of the TDF coefficient to be smaller than 0.0001 and not significantly different from zero at the 1% confidence level indicating that the under-performance results we obtain is not due to chance.

If agency issues do not play a role, then the difference in performance of TDFs relative to BFs can be construed as the premium that investors are willing to pay for the automatic rebalancing feature. To disentangle the two explanations, we compare the performance of the two structures of TDFs, namely FOFs and SFs, with that of BFs in the next sub-section.

4.4. Automatic-rebalancing versus strategic selection

To tease out the cause of under-performance, we investigate the performance of the subcategories of TDFs. To this end, we estimate the following regression for all TDFs and BFs in our data.

$$\begin{aligned} Perf_{i,t} =& \kappa_0 + \kappa_1 FOF_i + \kappa_2 SF_i + \kappa_3 ExpenseRatio_{i,t} + \kappa_4 LogAge_{i,t} + \\ & \kappa_5 LogAUM_{i,t} + \kappa_6 Turnover_{i,t} + \kappa_7 NetFlow_{i,t} + \\ & \kappa_8 FamilyAUM_{i,t} + \kappa_9 Bond_{i,t} + \epsilon_{i,t}, \end{aligned} \tag{7}$$

where the dependent variable $Perf_{i,t}$ is the performance measure of the i^{th} TDF in the t^{th} quarter, FOF_i is a dummy that takes the value 1 if the i^{th} TDF has FOF structure and 0 otherwise and SF_i is a dummy that takes the value 1 if the i^{th} TDF has SF structure and 0 otherwise. All other control variables are the same as defined in Equation 5.

We present the results for both performance measures in Table 7. BFs continue to be our baseline case implying that a negative coefficient on the FOF dummy variable indicates that BFs outperform TDFs with the FOF structure while a positive coefficient on the SF dummy variable indicates that TDFs with the SF structure outperform BFs. From the third and fourth columns of the table, we note that TDFs with the FOF structure under-perform BFs by 67 basis points annually on a net-of-fee risk-adjusted basis and 117 basis points annually on a gross-of-fee risk-adjusted basis. Similarly, from the fifth and sixth columns of the table, we can see that the Sharpe ratio of TDFs with the FOF structure is lower than the Sharpe ratio of BFs by 0.744, (0.764) on a net-of-fee (gross-of-fee) basis. The greater under-performance of the gross-of-fee specification implies that expense ratios are higher for SFs. To compute the average six-factor alpha for each of the category of funds, we evaluate Equation 7 using the mean values for the control variables. Based on our calculations, the

average net-of-fee (gross-of-fee) annual six-factor alpha for FOFs is $-2.04\,(-0.80)$ while that of SFs is $-1.23\,(0.49)$ and BFs is $-1.35\,(0.37)$. In the case of TDFs with the SF structure, the performance is not significantly different from that of BFs. Thus, we can rule out time-varying re-allocation as the main driver of the under-performance of TDFs. We also find that TDFs with the FOF structure under-perform TDFs with the SF structure by 79, (129) basis points annually using net-of-fee (gross-of-fee) alphas and by $0.66\,(0.68)$ annually based on net-of-fee (gross-of-fee) Sharpe ratios. We repeat the analysis in Equation 7 using the bootstrapped alphas to test whether the under-performance of the FOFs relative to SFs could occur purely by chance under the assumption that all funds have zero net-of-fee alphas. Our results indicate that the average of the relative performance differential between the FOFs and SFs is 0.0001 which is not significantly different from zero at the 1% confidence level. This shows that the under-performance of the FOFs that we observe in our data is not attributable to chance and the losses suffered by TDFs as shown in the earlier analysis is almost entirely driven by TDFs with the FOF structure.

Since TDFs with FOF structure under-perform those with SF structure in the net-of-fee as well as the gross-of-fee specification, the performance differential cannot be attributed to the dual layer of fees charged by TDFs with the FOF structure. However, if the under-performance is attributed to the reduction in risk due to diversification across funds, the shortfall of 79 to 129 basis points can be seen as the price paid by investors for this diversification. Alternately, the under-performance might arise due to "strategic" decisions made by the fund family. To disentangle the two explanations, we compare the performance of the two subgroups of FOFs namely, *External* FOFs and *Internal* FOFs, with that of the SFs in the next sub-section.

4.5. Costs and benefits of the fund-of-fund structure

As *External* FOFs came into existence only in 2005, our sample period for subsequent analyses consists of all TDFs over the period January 2005 to December 2008. To compare the performance of the *Internal* FOFs with that of *External* FOFs, we replace the FOF dummy by two dummy variables called *Internal* and *External*. *Internal* takes the value 1 if the funds' assets are invested entirely within the family and zero otherwise. Similarly, *External* takes the value 1 if the funds' assets are invested at least partially outside the family and zero otherwise. We continue to use the same set of control variables as before and estimate the following regression:

$$\begin{aligned} Perf_{it} =& \kappa_0 + \kappa_1 Internal_i + \kappa_2 External_i + \kappa_3 ExpenseRatio_{i,t} + \\ & \kappa_4 LogAge_{i,t} + \kappa_5 LogAUM_{i,t} + \kappa_6 Turnover_{i,t} + \\ & \kappa_7 NetFlow_{i,t} + \kappa_8 Bond_{i,t} + \kappa_9 FamilyAUM_{i,t} + \epsilon_{i,t}, \end{aligned} \tag{8}$$

where $Internal_i$ and $External_i$ are dummy variables as defined above and the performance measures as well as control variables are the same as in Equation 5.

We present our results for the above model in Table 8. In this analysis, we compare the performance of the *Internal* and *External* FOFs using TDFs with the SF structure as the baseline case. We can see that over our sample period, TDFs with the *Internal* FOF structure under-perform those with the SF structure for both net-of-fee as well as gross-of-fee specifications while TDFs with the *External* FOF structure under-perform those with the SF structure only when we use gross-of-fee alphas. This result implies that the under-performance of the FOFs cannot be entirely due to diversification across funds.

Consistent with our hypothesis, *Internal* FOFs under-perform *External* FOFs by 55 basis points based on net-of-fee performance and 63 basis points based on gross-of-fee performance.

However, there is no significant difference in performance based on Sharpe ratios. This might mean that *Internal* FOFs are exposed to greater systematic risk relative to *External* FOFs but have lower managerial ability. To compute the average six-factor alpha for each of the category of funds, we evaluate Equation 8 using the mean values for the control variables. Based on our calculations, the average net-of-fee (gross-of-fee) annual six-factor alpha for *Internal* FOFs is $-1.65\,(-1.22)$ while that of *External* FOFs is $-1.10\,(-0.60)$ and SFs is $-1.07\,(0.09)$. We use the bootstrap analysis explained in Subsection 4.4 to test whether the under-performance could occur purely by chance under the assumption that all TDFs have zero net-of-fee alphas. We find that the mean relative performance differential between *Internal* FOFs and *External* FOFs is -0.001 which is not significantly different from zero at the 1% confidence level suggesting that our results are not attributable to chance. Based on the results from our six-factor model, we contend that since both *Internal* and *External* FOFs have the FOF structure and carry out portfolio rebalancing at regular intervals, the under-performance of *Internal* FOFs cannot be explained by reduced risk, dual layer of fees or the timely reallocation of assets. Hence, "strategic" decisions that benefit the fund family over the investors is the probable cause of under-performance. In the next sub-section, we turn our attention to the selection decision of TDFs with the FOF structure. For all subsequent analyses we use the six-factor alphas as the performance measure.

4.6. Selection criteria of constituent funds by Internal fund-of-funds

To study the drivers of under-performance of the *Internal* FOFs, we analyze the selection process by which constituent funds are determined for the *Internal* FOFs and test whether fund families make these decisions to extract private benefits. To this end, we compare the constituents of the *Internal* FOFs to other funds in the family that are not part of any TDF at the point when those constituents are added. We estimate the probability that a fund

from a family is included in an *Internal* FOF using the following logistic regression model:

$$\begin{aligned} UF_{i,t} =& \kappa_0 + \kappa_1 Perf_{i,t-1} + \kappa_2 ExpenseRatio_{i,t-1} + \kappa_3 NetFlow_{i,t-1} + \\ & \kappa_4 LogAge_{i,t-1} + \kappa_5 LogAUM_{i,t-1} + \kappa_6 Turnover_{i,t-1} + \\ & \kappa_7 Bond_{i,t-1} + \kappa_8 LogFamAUM_{i,t-1}, \end{aligned} \tag{9}$$

where the dependent variable $UF_{i,t} = \ln\left(\frac{prob(Fund_{it} \text{ is a constituent of an Internal FOF})}{prob(Fund_{it} \text{ is not a constituent of an Internal FOF})}\right)$ is the log odds of the i^{th} fund being selected as a constituent of an *Internal* FOF in quarter t and the explanatory and control variables are as defined in Sections 3.2 & 3.3. To avoid forward-looking bias while using performance as an independent variable, for each fund we re-estimate the alphas for every quarter using our six-factor model for the 24 months prior to that quarter. We use one period lagged value for all the explanatory and control variables as these are likely to impact the selection decision of the constituent funds. We allow for standard errors to cluster by family and quarter. We provide the results of this analysis in Panel A of Table 9.

These results indicate that for any fund in the family, *ceteris paribus*, the probability of inclusion in the TDF is positively related to the expense ratio and negatively related to performance and net flows. In other words, funds selected by the *Internal* FOFs tend to have lower performance, higher expense ratios and lower net flows relative to other funds in the family. Additionally, these funds are likely to be smaller, older, and have greater allocation to bonds. Moreover, the significant negative value for coefficient of performance in the gross-of-fee specification raises questions about the ability of the managers of these constituent funds. If selection of poorly performing, high-expense funds as constituents by the *Internal* FOFs is done to derive private benefits, we expect TDFs with the FOF structure and investing in families outside to select funds with relatively better performance and lower expense. We test this conjecture in the next sub-section by comparing the characteristics of

the constituent funds of the *Internal* FOFs with those of the *External* FOFs.

4.7. Constituents of Internal fund-of-funds versus those of External fund-of-funds

To discern the determinants of including a fund in an *Internal* FOF versus an *External* FOF, we compare their constituent funds when they are initially included in the TDF. Our sample period for this analysis is from January 2005 to December 2008 as TDFs with the *External* FOF structure came into existence only in 2005. Given that a fund is a constituent fund for some TDF, we estimate the probability that it becomes a constituent fund of a TDF with the *Internal* FOF structure using the following logistic regression model:

$$\begin{aligned} UF_{i,t} = {} & \kappa_0 + \kappa_1 Perf_{i,t-1} + \kappa_2 ExpenseRatio_{i,t-1} + \kappa_3 NetFlow_{i,t-1} \\ & + \kappa_4 LogAge_{i,t-1} + \kappa_5 LogAUM_{i,t-1} + \kappa_6 Turnover_{i,t-1} \\ & + \kappa_7 Bond_{i,t-1} + \kappa_8 LogFamAUM_{i,t-1}, \end{aligned} \tag{10}$$

where the dependent variable $UF_{i,t} = \ln\left(\frac{prob(Fund_{it} \text{ is a constituent of an Internal FOF})}{prob(Fund_{it} \text{ is a constituent of an External FOF})}\right)$ is the log odds of the i^{th} fund being selected as a constituent of an *Internal* FOF in quarter t and the explanatory and control variables are as defined in Sections 3.2 & 3.3.

We provide the results of this analysis in Panel B of Table 9. Consistent with our expectations, we find that the coefficient of performance is negative indicating that fund families are more likely to choose funds with poor performance in the case of TDFs with the *Internal* FOF structure relative to TDFs with the *External* FOF structure. The results are striking given the fact that we have much fewer observations (169 vs 26812) compared to those in Panel A in which we compare constituent funds of *Internal* FOFs against other funds in the family. Furthermore, in the case of expense ratio, we find that funds with higher

expense ratios are more likely to be included in TDFs with the *Internal* FOF structure than in TDFs with the *External* FOF structure. However, we find the probability of inclusion of a constituent fund in a TDF with the *Internal* FOF structure is not additionally influenced by the net flows to the constituent fund relative to constituents of TDFs with the *External* FOF structure. Once again we find significant negative value for coefficient of performance in the gross-of-fee specification raising questions regarding the ability of managers of the constituent funds of *Internal* FOFs.

Overall, our results suggest that the under-performance of *Internal* FOFs could be due to the inclusion of constituent funds that have lower performance and higher expense ratios. These funds also have lower flows relative to other funds in the family suggesting that some fund families may be using TDFs as a vehicle to promote poorly performing funds, to increase revenues to the family, and to redirect flows to funds that are not favored by investors. Inclusion of funds with poor performance in TDFs raises the question regarding the cause of poor performance. On one hand, funds may perform poorly due to lack of managerial skills while on the other hand the under-performance might be a consequence of "strategic" decision by the management to use these funds to cross-subsidize certain other funds in the family. We follow the methodology of Gaspar, Massa, and Matos (2006) to test whether fund families with *Internal* FOFs practice cross-subsidization. In untabulated results, we find that funds in the bottom quartile of year-to-date returns within a family that offers TDFs with the *Internal* FOF structure are likely to under-perform similar funds from other families by 12 basis points per month which is suggestive of cross-subsidization. However, we cannot rule out lack of managerial skill as the cause of poor performance and leave the subject for future research.

5. Robustness checks

This section discusses several alternate specifications to show that the under-performance of TDFs with the *Internal* FOF structure is robust and present our results in Table 10. In untabulated results, we repeat all of our analysis using Carhart's (1997) four-factor model allowing for standard errors to cluster by families and quarters as well as family fixed-effects model allowing for standard errors to cluster by quarters and obtain qualitatively similar results. For ease of comparison, we begin with the results of our base model followed by different alternate specifications. For brevity, we only report the extent of under-performance for each case.

1. Base model: We compare the average performance of all TDFs with the average performance of all BFs over the period January 2001 to December 2008. We use net-of-fee and gross-of-fee risk adjusted performance measures in which risk adjustment is done using our six-factor model. Thus, we have two measures of performance of which the net-of-fee alphas are perhaps more pertinent to the investor.

2. An alternate way to control for family effects is to restrict the BFs to the families that offer TDFs. While this restriction effectively controls for family effects, it reduces our sample size. We present the results of this analysis as the first alternate specification in Table 10. From these results, we can see that the under-performance persists after controlling for family effects.

3. A shortcoming of our data is that in the case of TDFs with the FOF structure, we do not know the share class of the constituent funds. Consistent with Wermers (2000), we combine net returns, expense ratio, and other fund characteristics of all classes using the weighted average in which weights are based on assets in each share class. Thus, our analysis is at the fund level. If TDFs consistently invest in the share class with

lowest fees, our estimates for expense ratio and gross-of-fee returns may be overstated. To provide a lower bound, we repeat our analysis by choosing the lowest fees among share classes as the fees for the fund and present the results in the second alternate specification. We find the results to be qualitatively similar albeit a bit weaker for all cases except the under-performance of the *Internal* FOFs in which the results are stronger relative to the base-case.

4. In our analysis thus far, we have pooled funds with longer maturity along with shorter-maturity funds. However, longer-maturity funds might be systematically different from those with shorter-maturity. While our linear multi-factor model captures the differences in investment styles, there might be other fundamental differences in the two categories. Hence, we introduce an additional control variable that measures the years remaining to the target year. Our results indicate that the documented under-performance persists even after controlling for the number of years to maturity as shown in the third alternate specification of Table 10.

5. Another aspect that might affect our results is the approval of TDFs as QDIA in 2006 resulting in a surge in the number of TDFs. Particularly, *External* FOFs were introduced only around this period. Hence, the period before 2006 might be systematically different from the period after 2006. To control for this possibility, we exclude the observations in the year 2006 and include a dummy variable that takes the value 1 for the post-PPA period (January 2007 to December 2008) and 0 for the pre-PPA period (January 2001 to December 2005) to our regression analysis. We are unable to present this analysis for *Internal* FOFs and *External* FOFs due to lack of sufficient number of *External* FOFs in 2005. However, our results for under-performance persists for TDFs and FOFs as seen in the fourth alternate specification of Table 10.

6. As an additional control for the differences in asset allocation, we repeat our analysis using subsamples that are matched by the allocation to bonds. First, for each quarter we select up to ten BFs whose bond allocation differs by 10% from that of a given TDF and pool them after removing repetitions. This results in 1919 observations for TDFs and 6259 observations for BFs. Next, we construct subsamples of BFs and TDFs with the FOF structure whose bond allocation differs by 10% from that of a given TDF with the SF structure. In this case, our sample consists of 319 observations for TDFs with the SF structure, 809 observations for TDFs with the FOF structure and 2162 observations for BFs. Finally, we construct subsamples of TDFs with the SF structure and TDFs with the *Internal* FOF structure whose bond allocation differs by 10% from that of a given TDF with the *Exteranl* FOF structure. This sample consists of 162 observations for TDFs with the *External* FOF structure, 1178 observations for TDFs with the *Internal* FOF structure, and 146 observations for TDFs with the SF structure. We repeat our initial analysis on the matched samples and present the results as the fifth specification. We find that the under-performance persists for all three cases and is even stronger in the case of TDFs with the *Internal* FOF structure.

To summarize, our battery of robustness checks corroborate our key findings that TDFs under-perform BFs. Further, variation in asset allocation over time does not seem to drive this result as TDFs with the FOF structure are the ones with poor performance and not TDFs with the SF structure that perform at par with BFs. Finally, dual layer of fees or diversification across funds do not seem to explain the poor performance as TDFs with the *Internal* FOF structure under-perform those with the *External* FOF structure both on net-of-fee and gross-of-fee basis. These findings together point towards agency problems in the TDFs, more specifically towards those structured as FOFs and investing in the funds within their own families.

6. Conclusion

Retirement plan contributions to mutual funds have grown to $3.1 trillion, representing a third of total mutual fund assets, at the end of 2008.[14] During the recent financial crisis, the significant cross-sectional variation in the performance of Target-Date Funds (TDFs), whose assets are predominantly held in retirement accounts, led to an investigation by the Securities and Exchange Commission (SEC). Ours is the first empirical study examining the variation in performance across TDFs to show that agency problems may be responsible for the poor performance of certain TDFs. In particular, we find that the problems originate in TDFs that invest in other mutual funds within the fund family as it provides opportunities to redirect flows to poorly performing and high-fee funds. Furthermore, we establish that our results are not attributable to chance and are robust to alternate definition of expense ratios, variations in family characteristics, trends over time, as well as variations in asset allocation.

A potential reason for agency problems in TDFs is that flows do not respond to past performance indicating that investors neither reward good performance nor punish poor performance. However, we find that balanced funds, which is an alternate default option available in 401(k) plans with automatic enrollment, delivers superior performance and exhibits convex flow-performance relation indicating that its investors reward performance. A possible reason for the convex flow-performance relation in balanced funds is that it has considerable investor participation outside retirement plans. Hence, exposure of TDFs to such investors might be a possible solution to mitigate agency problems. Additionally, TDFs could be mandated to display their structure (funds investing in stocks and bonds, fund-of-funds investing within their own family, or fund-of-funds investing in other families).

[14] http://www.icifactbook.org/fb_sec7.html

A future area of research is to study other avenues of agency problems in TDFs. In particular, TDFs are required to rebalance their portfolios based on a predetermined asset allocation called the glide path. It is possible that TDFs could strategically deviate from the glide path to serve the fund family's incentives. These issues are part of our ongoing research agenda.

References

Agarwal, V., Gay, G. D., Ling, L., 2011. Window dressing in mutual funds. Unpublished working paper. Georgia State University.

Agarwal, V., Kale, J., 2007. On the relative performance of multi-strategy and funds of hedge funds. Journal of Investment Management 5(3), 41–63.

Agnew, J., Balduzzi, P., Sunden, A., 2003. Portfolio choice and trading in a large 401(k) plan. American Economic Review 93(1), 193–215.

Allen, F., Gorton, G., 1993. Churning bubbles. Review of Economic Studies 60(4), 813–836.

Ang, A., Rhodes-Kropf, M., Zhao, R., 2008. Do funds-of-funds deserve their fees-on-fees? Unpublished working paper. Columbia Universtiy.

Barber, B. M., Odean, T., Zheng, L., 2005. Out of sight, out of mind: the effects of expenses on mutual fund flows. The Journal of Business pp. 2095–2120.

Benartzi, S., Thaler, R. H., 2007. Heuristics and biases in retirement savings behavior. Journal of Economic Perspectives 21(3), 81–104.

Benzoni, L., Collin-Dufresne, P., Goldstein, R. S., 2007. Portfolio choice over the life-cycle when the stock and labor markets are cointegrated. The Journal of Finance 62(5), 2123–2167.

Berk, J. B., Green, R. C., 2004. Mutual fund flows and performance in rational markets. The Journal of Political Economy 112(6), 1269–1295.

Bhattacharya, U., Lee, J. H., Pool, V. K., 2010. Conflicting family values in mutual fund families. Unpublished working paper. Indiana Universtiy, Bloomington.

Blake, C. R., Elton, E. J., Gruber, M. J., 2003. Incentive fees and mutual funds. The Journal of Finance 58(2), 779–804.

——— , 2006. The adequacy of investment choices fooered by 401(k) plans. Journal of Public Economics 90, 1299–1314.

——— , 2007. Participant reaction and the performance of funds offered by 401(k) plans. Journal of Financial Intermediation 16(2), 249 – 271.

Bodie, Z., Merton, R. C., Samuelson, W. F., 1992. Labor supply flexibility and portfolio choice in a life-cycle model. Journal of Economic Dynamics and Control 16, 427–449.

Bodie, Z., Treussard, J., 2007. Perspectives:Making investment choices as simple as possible, but not simpler. Financial Analysts Journal 63(6), 42–47.

Brown, K. C., Harlow, W. V., Starks, L. T., 1996. Of tournaments and temptations: an analysis of managerial incentives in the mutual fund industry. Journal of Finance 51(1), 85–110.

Brown, S., Goetzmann, W. N., Park, J., 2001. Careers and survival: competition and risk in the hedge fund industry. Journal of Finance 56(5), 1869–1886.

Brown, S. J., Goetzmann, W. N., Liang, B., 2002. Fees on fees in funds of funds. Unpublished working paper. No. 02-33 New York University, Yale School of Management and University of Massachusetts at Amherst.

Carhart, M. M., 1997. On persistence in mutual fund performance. Journal of Finance 52(1), 57–82.

Carhart, M. M., Kaniel, R., Musto, D. K., Reed, A. V., 2002. Leaning for the tape: evidence of gaming behavior in equity mutual funds. The Journal Of Finance 57(2).

Chai, J., Horneff, W., Maurer, R., Mitchell, O. S., 2009. Extending life cycle models of optimal portfolio choice: integrating flexible work, endogenous retirement, and investment decisions with lifetime payouts. Unpublished working paper. National Bureau of Economic Research (NBER) WP 15079.

Chevalier, J., Ellison, G., 1997. Risk taking by mutual funds as a response to incentives. Journal of Political Economy 105(6), 1167–1200.

——— , 1999. Career concerns of mutual fund managers. Quarterly Journal of Economics 114(2), 389–432.

Choi, J. J., Laibson, D., Madrian, B., Metrick, A., 2006. Saving for retirement on the path of least resistance. in *In Behavioral Public Finance: Toward a New Agenda*, ed. by E. J. McCaffrey, and J. Slemrod. Russell Sage Foundation.

Cici, G., Gibson, S., Moussawi, R., 2010. Mutual fund performance when parent firms simultaneously manage hedge funds. Journal of Financial Intermediation 19(2), 169–187.

Cocco, J. F., Gomes, F. J., Maenhout, P. J., 2005. Consumption and portfolio choice over the life cycle. Review of Financial Studies 18(2), 491–533.

Cohen, L., Schmidt, B., 2009. Attracting flows by attracting big clients. Journal of Finance 64(5), 2125 – 2151.

Comer, G., 2006. Hybrid mutual funds and market timing performance. The Journal of Business 79(2), 771–797.

Cooper, M. J., Gulen, H., Rau, P. R., 2005. Changing names with style: mutual fund name changes and their effects on fund flows. The Journal of Finance 60(6), 2825–2858.

Davis, G. F., Kim, E. H., 2007. Business ties and proxy voting by mutual funds. Journal of Financial Economics 85, 552–570.

Dow, J., Gorton, G., 1997. Noise trading, delegated portfolio management, and economic welfare. Journal of Political Economy 105(5), 1024–1050.

Elton, E. J., Gruber, M. J., Green, T. C., 2007. The impact of mutual fund family membership on investor risk. Journal of Financial and Quantitative Analysis 42(02), 257–277.

Gallaher, S., Kaniel, R., Starks, L. T., 2005. Madison avenue meets wall street: mutual fund families, competition and advertising. Unpublished working paper. University of Texas at Austin and Duke University.

Gaspar, J.-M., Massa, M., Matos, P., 2006. Favoritism in mutual fund families? evidence on strategic cross-fund subsidization. Journal of Finance 61(1), 73–104.

Gomes, F., Michaelides, A., 2005. Optimal life-cycle asset allocation: understanding the empirical evidence. The Journal of Finance 60(2), 869–904.

Gomes, F. J., Kotlikoff, L. J., Viceira, L. M., 2008. Optimal life-cycle investing with flexible labor supply: a welfare analysis of life-cycle funds. American Economic Review 98(2), 297–303.

Gruber, M. J., 1996. Another puzzle: the growth in actively managed mutual funds. Journal of Finance 51(3), 783–810.

Guedj, I., Papastaikoudi, J., 2008. Can mutual fund families affect the performance of their funds? Unpublished working paper. University of Texas at Austin and MIT.

Guercio, D. D., Tkac, P. A., 2002. Determinants of the flow of funds of managed portfolios:mutual funds vs. pension funds. Journal of Financial and Quantitative Analysis 37(4), 523–557.

He, J., Ng, L., Wang, Q., 2004. Quarterly trading patterns of financial institutions. Journal of Business 77(3), 493–509.

Hilgert, M. A., Hogarth, J. M., Beverly, S. G., 2003. Household financial management: the connection between knowledge and behavior. Federal Reserve Bulletin pp. 309–322.

Hu, P., Kale, J. R., Pagani, M., Subramanian, A., 2011. Fund flows, performance, managerial career concerns, and risk-taking. Management Science 57(4), 628–646.

Huang, J., Wei, K. D., Yan, H., 2007. Participation costs and the sensitivity of fund flows to past performance. The Journal of Finance 62(3), 1273–1311.

Ivković, Z., Weisbenner, S., 2009. Individual investor mutual fund flows. Journal of Financial Economics 92(2), 223–237.

Jain, P. C., Wu, J. S., 2000. Truth in mutual fund advertising: evidence on future performance and fund flows. The Journal of Finance 55(2), 937–958.

Karceski, J., 2002. Returns-chasing behavior, mutual funds, and beta's death. The Journal of Financial and Quantitative Analysis 37(4), 559–594.

Khorana, A., Servaes, H., 1999. The determinants of mutual fund starts. Review of Financial Studies 12(5), 1043–1074.

Koijen, R. S. J., Nijman, T. E., Werker, B. J. M., 2010. When can life cycle investors benefit from time-varying bond risk premia? Review of Financial Studies 23(2), 741–780.

Kosowski, R., Timmermann, A., Wermers, R., White, H., 2006. Can Mutual Fund Stars Really Pick Stocks? New Evidence from a Bootstrap Analysis The Journal of Finance 61(6), 2551–2595.

Lakonishok, J., Shleifer, A., Thaler, R., Vishny, R. W., 1991. Window dressing by pension fund managers. The American Economic Review Papers and Proceedings 81(2), 227–231.

Lusardi, A., Mitchell, O., 2006. Financial literacy and planning: implications for retirement wellbeing. Unpublished working paper. 2006 - 1 Pension Research Council , The Wharton School.

——— , 2007a. Financial literacy and retirement planning: new evidence from the rand american life panel. Unpublished working paper. 2007-157 Michigan Retirement Research Center, University of Michigan, P.O. Box 1248, Ann Arbor, MI 48104.

——— , 2007b. Financial literacy and retirement preparedness: evidence and implications for financial education. Business Economics 42, 35–44.

——— , 2007c. Baby boomer retirement security: the roles of planning, financial literacy, and housing wealth. Journal of Monetary Economics 54(1), 205 – 224.

Madrian, B. C., Shea, D. F., 2001. The power of suggestion: inertia in 401(k) participation and savings behavior. Quarterly Journal of Economics 116(4), 1149–1187.

Massa, M., 2003. How do family strategies affect fund performance? When performance-maximization is not the only game in town. Journal of Financial Economics pp. 249–304.

Meier, I., Schaumburg, E., 2004. Do funds window dress? evidence for U.S. domestic equity mutual funds. Unpublished working paper. Northwestern University.

Mitchell, O. S., Mottola, G. R., Utkus, S. P., Yamaguchi, T., 2006. The inattentive participant: portfolio trading behavior on 401(k) plans. Unpublished working paper. Pension Research Council.

——— , 2007. The dynamics of lifecycle investing in 401(K) plans. .

Nanda, V., Wang, J. Z., Zheng, L., 2004. Family values and the star phenomenon: strategies of mutual fund families. Review of Financial Studies 17(3), 667–698.

Ng, L., Wang, Q., 2004. Institutional trading and the turn-of-the-year effect. Journal of Financial Economics 74(2), 343–366.

Polkovnichenko, V., 2007. Life-Cycle portfolio choice with additive habit formation preferences and uninsurable labor income risk. Review of Financial Studies 20(1), 83–124.

Poterba, J. M., Rauh, J., Venti, S. F., Wise, D. A., 2009. Lifecycle Asset Allocation Strategies and the Distribution of 401(k) Retirement Wealth.University of Chicago Press pp. 15–50.

Sirri, E. R., Tufano, P., 1998. Costly search and mutual fund flows. Journal of Finance 53(5), 1589–1622.

Viceira, L. M., 2001. Optimal portfolio choice for long-horizon investors with nontradable labor income. The Journal of Finance 56(2), 433–470.

——— , 2009. Life-cycle funds. in *Overcoming the saving slump: How to increase the effectiveness of financial education and savings program.*, ed. by A.Lusardi. University of Chicago Press, Chicago, IL.

Wermers, R., 2000. Mutual fund performance: an empirical decomposition into stock-picking talent, style, transactions costs, and expenses. Journal of Finance 55(4), 1655–1695.

Table 1: Growth in Target-Date Funds (2001 - 2008)

This table presents the number of funds (# Funds) as well as the assets under management (AUM) in billions of dollars annually during our sample period, January 2001 - December 2008. Top panel provides the statistics for Target-Date Funds (TDF) and balanced funds (BF). Middle panel reports the statistics for the two major subcategories of TDFs, namely funds that invest in other mutual funds (FOF) and funds that invest in stocks and bonds (SF). Bottom panel presents the three sub-groups of TDFs with the FOF structure; funds that invest within the family (*Internal* FOF), funds that invest outside the family (*External* FOF), and funds that invest within the family as well as outside the family (*Mixed* FOF).

	TDF		BF	
Years	# Funds	AUM	# Funds	AUM
2001	16	11.287	264	146.135
2002	20	13.411	277	140.034
2003	41	22.786	282	166.655
2004	69	34.553	301	187.024
2005	112	53.284	280	193.603
2006	158	84.633	285	204.415
2007	200	131.737	307	227.734
2008	280	126.792	383	214.883

	FOF		SF	
Years	# Funds	AUM	# Funds	AUM
2001	7	9.700	9	1.587
2002	11	12.073	9	1.338
2003	28	20.746	13	2.040
2004	56	31.536	13	3.016
2005	99	49.308	13	3.976
2006	145	79.547	13	5.086
2007	187	124.299	13	7.439
2008	266	121.082	14	5.710

	Internal FOF		*External* FOF		*Mixed* FOF	
Years	# Funds	AUM	# Funds	AUM	# Funds	AUM
2001	7	9.700	0	0.000	0	0.000
2002	11	12.073	0	0.000	0	0.000
2003	28	20.746	0	0.000	0	0.000
2004	56	31.536	0	0.000	0	0.000
2005	86	49.159	2	0.009	11	0.141
2006	119	78.023	12	0.065	14	1.459
2007	161	120.364	12	0.798	14	3.137
2008	209	114.446	19	1.584	38	5.052

Table 2: Flow-Performance Relation

This table presents the relation of flows to past performance for Target-Date Funds (TDF) and balanced funds (BF) during the period January 2003 to December 2008. In the first two columns we present the results using linear regression model while in the last two columns we use a piece-wise linear model. Net flows for fund i in quarter t is defined as $Netflow_{it} = (AUM_{i,t} - AUM_{i,t-1} * (1 + R_{i,t}))/(AUM_{i,t-1})$. For the linear model, the explanatory variable is Performance (quarterly net-of-fee six-factor alpha). For the piece-wise linear model, we calculate the fractional ranks (RANK) within each investment objective for each quarter. Low performance (Low Perf) is defined as Min(0.2,RANK) while Medium Performance (Medium Perf) is defined as Min(0.6,RANK-Low Perf) and High performance (High Perf) is defined as RANK - (Low Perf + Medium Perf). The control variables are log of prior period AUM (Log Lag AUM), prior period expense ratio (Lag Exp Ratio), flows to funds with similar investment objective (Flows to Obj), and the standard deviation of monthly returns for the prior 24 months (Std Dev). The standard errors are reported in square brackets. Coefficients marked with ***, **, and * are significant at 1%, 5%, and 10% level respectively.

	Linear Model		Piece-wise Linear Model	
	BFs	TDFs	BFs	TDFs
Performance	0.189***	−0.094		
	[0.052]	[0.166]		
Low Perf			6.150	25.247
			[7.096]	[79.257]
Medium Perf			4.657***	12.463
			[1.778]	[10.247]
High Perf			19.272**	−24.913
			[7.954]	[21.372]
Log Lag AUM	−1.311***	−4.682**	−1.336***	−4.570*
	[0.255]	[2.354]	[0.259]	[2.519]
Lag Exp Ratio	−2.765***	−15.743	−2.663***	−0.161
	[0.671]	[11.883]	[0.681]	[0.122]
Flows to Obj	−2.254	0.145	−3.071	0.116
	[6.567]	[0.194]	[5.936]	[0.168]
Std Dev	0.925***	2.027	0.906***	2.374
	[0.274]	[2.005]	[0.253]	[1.855]
Constant	1.461	2.632	−2.519	−5.897
	[1.431]	[5.287]	[1.996]	[16.864]
Observations	10321	236	10321	236
Adjusted R^2	0.021	0.049	0.024	0.058

Table 3: Fund Characteristics of TDFs and BFs

This table presents the average annual fund characteristics such as performance measured using six-factor alphas (annualized monthly alphas estimated over two-year periods using a six-factor model that includes a bond factor and international equity factor along with the four-factors used in Carhart (1997)) and Sharpe ratios (calculated using monthly returns), Assets in Billions (dollar value of assets in fund's portfolio), Age in Years (number of years since inception), Turnover Ratio (ratio of minimum purchases and sales made by the fund to the total assets under management), Flows (net flows to the fund), Expense Ratio (percentage of fund assets paid for operating expenses, management fees, and 12B-1 fees excluding sales charges), Equity/Bond Component (proportion of assets allocated to equities/bonds), and Volatility of Returns (annualized monthly volatility of fund returns) for BFs and TDFs for the years 2001 to 2008. Equity and Bond Components do not add to 100 as a portion of assets are held as cash. For TDFs that invest in other mutual funds, constituent expense ratio (turnover ratio) is the value-weighted average of the expense ratios (turnover ratios) of the constituent funds. The third column provides the results of a t-test that compares the means of BFs to TDFs. Differences marked with ***, **, and * denote significance at 1%, 5%, and 10% level respectively.

Fund Characteristics	BF	TDF	BF - TDF
6 Factor Alpha (%) Net	−0.881	−2.231	1.350***
6 Factor Alpha (%) Gross	0.704	−1.811	2.515***
Sharpe Ratio Net	0.019	−0.496	0.516***
Sharpe Ratio Gross	0.170	−0.422	0.592***
Assets in Billions	0.656	0.618	0.038
Age in Years	13.601	3.452	10.149***
Turnover Ratio (%)	82.492	31.093	51.398***
Constituent Turnover Ratio(%)	NA	76.36	NA
Flows (%)	3.451	32.352	−28.900***
Expense Ratio (basis points)	113.280	43.199	70.080***
Constituent Expense Ratio (basis points)	NA	69.788	NA
Equity Component (%)	59.994	72.390	−12.400***
Bond Component (%)	29.278	19.612	9.666***
Volatility of Returns (%)	2.752	4.283	−1.530***

Table 4: Fund Characteristics of FOFs and SFs

This table presents the average annual fund characteristics of the two subcategories of Target-Date Funds (TDF), namely funds that invest in other funds (FOF structure) and funds that invest in stocks and bonds (SF structure), over the years 2001 to 2008. Performance is measured using six-factor alphas (annualized monthly alphas estimated over two-year periods using a six-factor model that includes a bond factor and international equity factor along with the four-factors used in Carhart (1997)) as well as Sharpe ratios (calculated using monthly returns). Other fund characteristics compared are as defined in Table 3. Constituent expense ratio (turnover ratio) is the value-weighted average of the expense ratios (turnover ratios) of the constituent funds. The third column provides the results of a t-test that compares the means of FOFs with SFs. Differences marked with ***, **, and * denote significance at 1%, 5%, and 10% level respectively.

Fund Characteristics	FOF	SF	FOF - SF
6 Factor Alpha (%) Net	−2.442	−0.681	−1.761***
6 Factor Alpha (%) Gross	−2.166	0.797	−2.963***
Sharpe ratio Net	−0.587	0.035	−0.622***
Sharpe ratio Gross	−0.523	0.171	−0.694***
Assets in Billions	0.657	0.331	0.327***
Age in Years	2.552	10.039	−7.487***
Turnover Ratio (%)	28.221	45.867	−17.650***
Constituent Turnover Ratio(%)	76.360	NA	NA
Flows (%)	36.324	4.548	31.776***
Expense Ratio (basis points)	31.831	101.880	−70.050***
Constituent Expense Ratio (basis points)	69.788	NA	NA
Equity Component (%)	73.717	62.648	11.069***
Bond Component (%)	18.077	29.497	−11.420***
Volatility of Returns (%)	4.479	2.844	1.635***

Table 5: Fund Characteristics of *Internal*, *External*, and *Mixed* FOFs

This table presents the average fund characteristics for the three sub-categories of Target-Date Funds (TDF) with fund-of-fund (FOF) structure (funds that invest within the family (*Internal* FOF), funds that invest outside the family (*External* FOF), and funds that invest within and outside the family (*Mixed* FOF)) for the sample period January 2005 to December 2008. Performance is measured using six-factor alphas (annualized monthly alphas estimated over two-year periods using a six-factor model that includes a bond factor and international equity factor along with the four-factors used in Carhart (1997)) as well as Sharpe ratios (calculated using monthly returns). Other fund characteristics compared are as defined in Table 3. Constituent expense ratio (turnover ratio) is the value-weighted average of the expense ratios (turnover ratios) of the constituent funds. Columns two, three, and four present the average values of fund characteristics for *Internal*, *External*, and *Mixed* FOFs. Column five (six / seven) provides the results of a t-test that compares the means of *External* (*Mixed* / *Mixed*) FOF with *Internal* (*External* / *Internal*) FOF. Differences marked with ***, **, and * denote significance at 1%, 5%, and 10% level respectively.

Fund Characteristics	External	Internal	Mixed	Ext - Int	Mix - Ext	Mix - Int
6 Factor Alpha (%) Net	−1.618	−1.907	−1.859	0.289**	−0.240	0.048
6 Factor Alpha (%) Gross	−0.992	−1.615	−1.555	0.623***	−0.563	0.060
Sharpe Ratio (%) Net	−1.005	−0.659	−0.367	−0.346**	0.638***	0.291*
Sharpe Ratio (%) Gross	−0.943	−0.557	−0.261	−0.386**	0.682***	0.296*
Assets in Billions	0.083	0.557	0.280	−0.473***	0.196***	−0.277***
Age in Years	1.692	2.706	2.428	−1.014***	0.737***	−0.277
Turnover Ratio (%)	15.544	32.458	43.529	−16.910***	27.985***	11.071**
Constituent Turnover Ratio(%)	30.962	79.229	109.170	−48.270***	78.213***	29.946***
Flows (%)	34.706	23.055	42.674	11.650***	7.9682	19.618**
Expense Ratio (basis points)	60.040	28.366	25.245	31.674***	−34.790***	−3.120
Constituent Expense Ratio (basis points)	44.456	78.739	64.793	−34.280***	20.337***	−13.95***
Equity Component (%)	86.335	72.249	73.543	14.087***	−12.790***	1.295
Bond Component (%)	10.626	16.918	22.737	−6.293***	12.112***	5.819**
Volatility of Returns (%)	4.982	4.142	4.586	0.840***	−0.397***	0.443***

Table 6: Under-performance of TDFs over BFs

This table reports the results for the hypothesis that Target-Date Funds (TDF) under-perform balanced funds (BF) using quarterly data for the period January 2001 - December 2008 with BFs as the base case. The dependent variable fund performance is measured using six-factor alphas (annualized monthly alphas estimated over two-year periods using a six-factor model that includes a bond factor and an international equity factor along with Carhart's (1997) four factors) expressed as a percentage as well as annualized Sharpe ratios. The explanatory variable TDF is a dummy variable that takes the value 1 when the fund is a TDF and 0 when the fund is a BF. The control variables include the Expense Ratio (percentage of fund assets paid for operating expenses, management fees, and 12B-1 fees excluding sales charges), Log Age (logarithm of fund's age expressed in years), Log AUM (log of assets under management in billions of dollars), Turnover (ratio of minimum purchases and sales made by the fund to its AUM expressed as percentage), Net Flow (net flows to the fund for the quarter), Family AUM (total assets under management of the fund family in billions of dollars), and BOND (percentage composition allocated to bonds). The second column provides the expected sign for the explanatory variables. The third (last) column reports the results when performance is measured on a net-of-fee (gross-of-fee) basis. White standard errors adjusted to account for autocorrelation within clusters ("cluster" variables are fund family and quarter) are reported below the coefficients in square brackets. Coefficients marked with ***, **, and * are significant at 1%, 5%, and 10% level respectively.

Variables	Exp Sign	Six-factor Alpha		Sharpe Ratio	
		Net-of-fee	Gross-of-fee	Net-of-fee	Gross-of-fee
TDF	Negative	-0.475^{***}	-0.855^{***}	-0.585^{**}	-0.602^{**}
		[0.144]	[0.245]	[0.235]	[0.241]
Expense Ratio		-0.038	1.345^{***}	0.069	0.194^{**}
		[0.067]	[0.078]	[0.093]	[0.090]
Log Age		0.058	0.162^{***}	0.046	0.048
		[0.039]	[0.052]	[0.036]	[0.038]
Log AUM		-0.013	-0.014	0.031^{*}	0.030
		[0.017]	[0.020]	[0.018]	[0.019]
Turnover		-0.033	-0.076^{*}	-0.001^{*}	-0.001^{*}
		[0.035]	[0.041]	[0.000]	[0.000]
Net Flow		-0.091	-0.087	0.004^{***}	0.004^{***}
		[0.103]	[0.121]	[0.001]	[0.001]
Log Family AUM		-0.002	-0.006	-0.005	-0.003
		[0.015]	[0.018]	[0.012]	[0.013]
BOND		0.011^{***}	0.014^{***}	-0.002^{*}	-0.001
		[0.002]	[0.002]	[0.001]	[0.001]
Constant		-1.141^{***}	-1.340^{***}	0.074	0.027
		[0.186]	[0.203]	[0.284]	[0.283]
# of Observations		11895	11895	11531	11531
Adjusted R^2		0.049	0.329	0.030	0.036

Table 7: Under-performance of FOFs over SFs

This table reports the results for the hypothesis that Target-Date Funds (TDF) with the fund-of-fund (FOF) structure under-perform those with the Single fund (SF) structure using quarterly data for the period January 2001 - December 2008 with balanced funds as the base case. The dependent variable fund performance is measured using six-factor alphas (annualized monthly alphas estimated over two-year periods using a six-factor model that includes a bond factor and an international equity factor along with Carhart's (1997) four factors) expressed as a percentage as well as annualized Sharpe ratios. The explanatory variable FOF (SF) is a dummy variable that takes the value 1 when a TDF has FOF (SF) structure and 0 otherwise. We use the same set of control variables as in Table 6. The second column provides the expected sign for the explanatory variables. The third (last) column reports the results when performance is measured on a net-of-fee (gross-of-fee) basis. In the case of FOFs, we divide the sum of the equal weighted average of the expense ratios of the constituent funds and the expense ratio of the fund by 12 and add to the monthly returns of the TDF to get the gross-of-fee returns. White standard errors adjusted to account for autocorrelation within clusters ("cluster" variables are fund families and quarters) are reported below the coefficients in square brackets. Coefficients marked with ***, **, and * are significant at 1%, 5%, and 10% level respectively.

Variables	Exp Sign	Six-factor Alphas		Sharpe Ratio	
		Net-of-fee	Gross-of-fee	Net-of-fee	Gross-of-fee
FOF	Negative	-0.669^{***}	-1.172^{***}	-0.744^{***}	-0.764^{***}
		[0.149]	[0.269]	[0.274]	[0.282]
SF	Not Negative	0.121	0.116^{*}	−0.079	−0.084
		[0.075]	[0.064]	[0.057]	[0.056]
Expense Ratio		−0.056	1.316^{***}	0.050	0.176^{**}
		[0.068]	[0.076]	[0.090]	[0.087]
Log Age		0.031	0.116^{**}	0.020	0.022
		[0.038]	[0.048]	[0.036]	[0.037]
Log AUM		−0.011	−0.010	0.031^{*}	0.030
		[0.018]	[0.020]	[0.017]	[0.018]
Turnover		−0.027	−0.065	−0.001	−0.000
		[0.034]	[0.040]	[0.000]	[0.000]
Net Flow		−0.063	−0.041	0.004^{***}	0.004^{***}
		[0.098]	[0.121]	[0.001]	[0.001]
Log Family AUM		−0.001	−0.005	-0.003^{**}	−0.001
		[0.016]	[0.018]	[0.001]	[0.001]
BOND		0.010^{***}	0.013^{***}	−0.004	−0.002
		[0.002]	[0.002]	[0.012]	[0.013]
Constant		-1.050^{***}	-1.192^{***}	0.155	0.110
		[0.192]	[0.199]	[0.278]	[0.276]
FOF - SF	Negative	-0.789^{***}	-1.287^{***}	-0.665^{***}	-0.680^{***}
Observations		11895	11895	11531	11531
Adjusted R^2		0.056	0.339	0.035	0.041

Table 8: Under-performance of *Internal* FOFs over *External* FOFs

This table reports the results for the hypothesis that Target-Date Funds (TDF) with the fund-of-fund (FOF) structure that invest in funds within the family (*Internal* FOF) under-perform those investing in funds from other families (*External* FOF). The data comprises of all TDFs over the period January 2005 - December 2008 and TDFs with the Single fund (SF) structure serves as the base case for this specification. The explanatory variable Internal (External) is a dummy variable that takes the value 1 when the FOF invests internally (externally) and 0 otherwise. The dependent variable and control variables are as defined in Table 6. The second column provides the expected sign for the explanatory variables while the third (last) column reports the results when performance is measured on a net-of-fee (gross-of-fee) basis. We divide the sum of the equal weighted average of the expense ratios of the constituent funds and the expense ratio of the fund by 12 and add to the monthly returns to get the gross-of-fee returns. The difference between the coefficients on Internal and External (*Int - Ext*) is also reported, and an F-test for the significance of this difference is performed. White standard errors adjusted to account for autocorrelation within clusters ("cluster" variables are fund families and quarters) are reported below the coefficients in square brackets. Coefficients and differences marked with ***, **, and * are significant at 1%, 5%, and 10% level respectively.

Variables	Exp Sign	Six-factor Alpha		Sharpe Ratio	
		Net-of-fee	Gross-of-fee	Net-of-fee	Gross-of-fee
Internal	Negative	-0.579^{**}	-1.317^{***}	-0.859^{**}	-0.896^{**}
		[0.281]	[0.338]	[0.345]	[0.352]
External	Not negative	-0.033	-0.691^{*}	-0.792^{*}	-0.831^{**}
		[0.310]	[0.359]	[0.409]	[0.415]
Expense Ratio		-0.174	0.306	-0.011	0.074
		[0.312]	[0.324]	[0.181]	[0.189]
Log Age		0.255^{*}	0.356^{**}	-0.267	-0.274
		[0.154]	[0.173]	[0.167]	[0.170]
Log AUM		0.095	0.088	0.142^{***}	0.142^{***}
		[0.131]	[0.145]	[0.044]	[0.045]
Turnover		-0.027	-0.300^{**}	-0.001	-0.001
		[0.085]	[0.118]	[0.001]	[0.001]
Net Flow		-0.223	-0.225	0.006^{***}	0.006^{***}
		[0.182]	[0.189]	[0.002]	[0.002]
BOND		0.004	0.006^{*}	0.008^{***}	0.009^{***}
		[0.003]	[0.003]	[0.003]	[0.003]
Log Family AUM		0.043	-0.005	-0.019	-0.021
		[0.075]	[0.093]	[0.044]	[0.045]
Constant		-1.268^{*}	-0.249	0.609	0.633
		[0.674]	[0.738]	[0.556]	[0.560]
Int - Ext	Negative	-0.547^{*}	-0.627^{*}	-0.067	-0.065
# of Observations		1974	1974	2209	2209
Adjusted R^2		0.176	0.317	0.099	0.100

Table 9: Determinants of Constituents of *Internal* FOFs

This table reports the results for the probability of a fund becoming the constituent of an *Internal* FOF using quarterly data for the period January 2005 - December 2008. The dependent variable $UF_{i,t}$ is defined as the logarithm of the odds of a fund being the constituent of an *Internal* FOF given that it belongs to a family that offers a TDF with *Internal* FOF structure in Panel A, and the logarithm of the odds of a fund being the constituent of an *Internal* FOF given that it is the constituent of a TDF in Panel B. The explanatory variables are Performance (annualized monthly net and gross of fee alphas estimated over the previous 24 months using a six-factor model that includes a bond factor and an international equity factor along with Carhart's (1997) four factors), Expense Ratio (percentage of fund assets paid for operating expenses, management fees, and 12B-1 fees excluding sales charges for the previous quarter), and Net flows (net flows to the fund for the previous quarter) expressed as percentages. We use one-period lagged value of the control variables which are as defined in Table 6. The second and fifth columns provide the expected sign for the explanatory variables while the third and sixth (fourth and last) columns report the results when performance is measured on a net-of-fee (gross-of-fee) basis. White standard errors adjusted to account for autocorrelation within clusters ("cluster" variables are fund family and quarter) are reported below the coefficients in square brackets. Coefficients marked with ***, **, and * are significant at 1%, 5%, and 10% level respectively.

		Panel A			Panel B	
Variables	Exp Sign	Net-of-fee alphas	Gross-of-fee alphas	Exp Sign	Net-of-fee alphas	Gross-of-fee alphas
Performance	Negative	-0.046^{***}	-0.039^{***}	Negative	-0.068^{***}	-0.063^{***}
		[0.009]	[0.008]		[0.020]	[0.012]
Expense Ratio	Positive	0.686^{*}	1.228^{***}	Positive	3.833^{***}	4.532^{***}
		[0.366]	[0.408]		[0.435]	[0.519]
Net Flow	Negative	-0.720^{*}	-0.666	Negative	0.130	0.228
		[0.415]	[0.419]		[0.527]	[0.556]
Log Age		0.724^{***}	0.742^{***}		0.683^{***}	0.719^{***}
		[0.130]	[0.132]		[0.187]	[0.192]
Log AUM		-0.987^{***}	-0.996^{***}		-0.111	-0.098
		[0.153]	[0.155]		[0.154]	[0.162]
Turnover		-0.044	-0.064		0.266	0.250
		[0.320]	[0.308]		[0.229]	[0.222]
BOND		0.023^{***}	0.023^{***}		0.017^{***}	0.017^{***}
		[0.009]	[0.009]		[0.005]	[0.005]
Log Family AUM		0.048	0.053		0.046	0.028
		[0.115]	[0.113]		[0.079]	[0.089]
Constant		2.454^{***}	2.378^{***}		-4.755^{***}	-4.643^{***}
		[0.904]	[0.876]		[1.478]	[1.443]
# of Observations		26812	26812		169	169

Table 10: Tests for Robustness

This table presents the robustness of our results for various alternate specifications. For ease of comparison, we report only the coefficients of the extent of under-performance for all cases. The baseline refers to the specification in which performance is measured using annualized monthly alphas estimated over two-year periods using a six-factor model that includes a bond factor and an international equity factor along with Carhart's (1997) four factors. Coefficients and differences marked with ***, **, and * are significant at 1%, 5%, and 10% level respectively.

Specifications	TDF -BF	Adj R^2	FOF -SF	Adj R^2	*Internal* FOF - *External* FOF	Adj R^2
Baseline:						
Net-of-fee	-0.475^{***}	0.049	-0.789^{***}	0.056	-0.547^{*}	0.176
Gross-of-fee	-0.855^{***}	0.329	-1.287^{***}	0.339	-0.627^{*}	0.317
# of observations	11895		11895		1974	
Alternate 1: TDFs are compared to BFs offered by the same family.						
Net-of-fee	-0.159^{*}	0.030	-0.407^{***}	0.034	-0.812^{**}	0.131
Gross-of-fee	-0.166	0.282	-0.456^{***}	0.285	-0.831^{**}	0.305
# of observations	4402		4402		1348	
Alternate 2: Using share class with minimum fees.						
Net of Fee	-0.196^{**}	0.026	-0.485^{***}	0.029	-0.822^{**}	0.135
Gross of Fee	-0.178^{*}	0.296	-0.484^{***}	0.298	-0.839^{**}	0.309
# of observations	11537		11537		1350	
Alternate 3: Controlling for years to maturity.						
Net of Fee	-0.311^{**}	0.050	-0.806^{***}	0.058	-0.544^{**}	0.189
Gross of Fee	-0.675^{***}	0.330	-1.306^{***}	0.341	-0.624^{*}	0.330
# of observations	11895		11895		1974	
Alternate 4: Controlling for time trends.						
Net of Fee Pre-PPA	-0.183	0.108	-0.686^{***}	0.112		
Net of Fee Post-PPA	-0.221^{**}		-0.194^{*}			
Gross of Fee Pre-PPA	-0.218	0.392	-0.762^{***}	0.396		
Gross of Fee Post-PPA	-0.718^{***}		-0.737^{***}			
# of observations	10032		10032			
Alternate 5: Controlling for asset allocation.						
Net of Fee	-0.314^{**}	0.056	-0.512^{**}	0.079	-0.849^{**}	0.112
Gross of Fee	-0.697^{***}	0.312	-0.988^{***}	0.349	-0.932^{**}	0.183
# of observations	8178		3290		1486	